ASHTON INTERNATIONAL COLLEGE

BALLITO

Mathematics
Paper 1

FORM 4
NOVEMBER 2018

TIME: 3 hours	TOTAL: 150 marks
Examiner: Mrs Gunning	**Moderated: Miss Eastes, Mrs Algie**

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY
BEFORE ANSWERING THE QUESTIONS.

- This question paper consists of 13 questions, 9 pages. You are also given an Information Sheet.

- Answer all questions in your Answer booklet.

- Read and answer all questions carefully. Write legibly and present your work neatly.

- All necessary working which you have used in determining your answers **must** be clearly shown.

- Approved non-programmable calculators may be used except where otherwise stated. Where necessary give answers correct to **1 decimal place** unless otherwise stated.

- Ensure that your calculator is in DEGREE mode.

- Diagrams have not necessarily been drawn to scale.

SECTION A

Question 1

(a) Solve each of the following. Remember to show all relevant working which you have

used to get your answers. Using the SOLVE on your calculator and giving the answers

only will get 0.

      (i) $(2x - 1)(x + 3) = 9$ (3)

      (ii) $\dfrac{15}{x-1} - \dfrac{x+3}{x^2+x} = \dfrac{12}{x}$ (5)

      (iii) $2x + \sqrt{x + 1} = 1$ (5)

      (iv) $-3(3x + 1)(x - 4) < 0$ (3)

      (v) $4x^2 + 8x = 12$ (by completing the square)   (4)

(b) Solve the following equations simultaneously

    $2x - y = 8$ and $x^2 - xy + y^2 = 19$ (6)

                                                   [26]

Question 2

(a) Simplify the following expressions fully, <u>without the use of a calculator</u>, and <u>showing all</u>

<u>relevant working detail.</u>

      (i) $4x^{\frac{1}{2}} \times \left(8x^3\right)^{-\frac{1}{3}}$ (3)

      (ii) $\dfrac{6^{n+2}.2^{n-1}}{12^{n+2}}$ (3)

      (iii) $\dfrac{3^{x+1}+3^x}{2.3^x+3^x.2^3}$ (3)

(b) Solve for x:

      $2^{x+2} + 2^x = 20$ (4)

                                                          [13]

Question 3

The following data was obtained from the financial office at a certain university:

	Receiving financial aid	Not receiving financial aid	**TOTAL**
Undergraduates	4 222	3898	8120
Postgraduates	1879	731	2 610
TOTAL	6 101	4 629	10730

(a) Determine the probability that a student selected at random is receiving financial aid. (2)

(b) Given that a person is an undergraduate, what is the probability that he is receiving financial aid. (2)

(c) Are the events "being an undergraduate" and "not receiving financial aid" independent or not? Show working to support your answer. (5)

[9]

Question 4

Given the quadratic sequence: – 1 ; – 7 ; – 11 ; p ; . . . .

(a) Write down the value of p. (1)

(b) Determine the nth term of the sequence. (3)

[4]

Question 5

Emma's investment grows from R7000 to R9304,60 in a period of 3 years. Interest is compounded quarterly.

(a) Calculate the nominal interest rate on her investment. (4)

(b) Calculate the effective annual interest rate on her investment. (3)

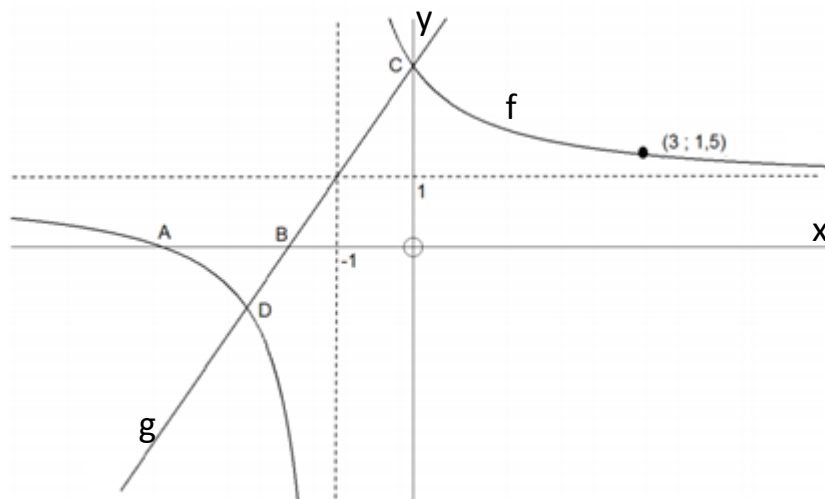**[7]**

Question 6

Sketched on the axes below are the functions $f(x)$ and $g(x)$.

A and B are the x-intercepts of the functions. C is the common y-intercept of the two

functions. D is one of the points of intersection of the two functions.

The point $(3; 1{,}5)$ lies on $f(x)$.

(a) State the equations of the asymptotes of $f(x)$. (2)

(b) Determine the equation of $f(x)$. (3)

(c) Determine the equation of the axis of symmetry with a positive gradient of $f(x)$.

(2)

(d) Hence determine the coordinates of A and C. (3)

(e) Given that $g(x)$ passes through the point of intersection of the asymptotes of

$f(x)$, show that $g(x) = 2x + 3$. (2)

(f) Determine the co-ordinates of D. (5)

[17]

SECTION B

Question 7

Given the function $f(x) = 4.2^{x-1} + 1$

(a) State the equation of the asymptote. (1)

(b) State the domain and range of the function. (2)

(c) Determine the equation of $g(x)$ if $g(x)$ is formed when $f(x)$ is reflected over the

x-axis. (2)

(d) Determine the equation of $h(x)$ if $h(x)$ is formed when $f(x)$ is shifted 2 units right

and 3 units down. (2)

(e) Using your own axes, make a neat sketch graph of $f(x)$. Show all intercepts and

asymptotes. (4)

[11]

Question 8

Solve for x, giving your answer(s) in each case in terms of the literal coefficients. (ie

in terms of a, c, d, p or m; where applicable)

(a) $ax + c = px - d$ (2)

(b) $(mx + 1)(x - m) = 0$ (2)

(c) $-2x < 4 - 10m$ (2)

[6]

Question 9

A given quadratic pattern $T_n = an^2 + bn + c$ has $T_2 = T_4 = 0$ and a second

difference of 12. Determine the value of the 1st and 3rd terms of the pattern. (6)

[6]

Question 10

(Answers to all these questions must be given correct to 2 decimal places.)

(a) A school decides that they are going to invest R60 000 at 12% p.a. compounded monthly in order to put up floodlights on the Hockey AstroTurf. Three years later the interest rate drops by 1% and it was compounded quarterly. Four years after the first investment, R10 000 is withdrawn to buy rugby poles. What is the total investment worth 13 years after the first investment was made? (5)

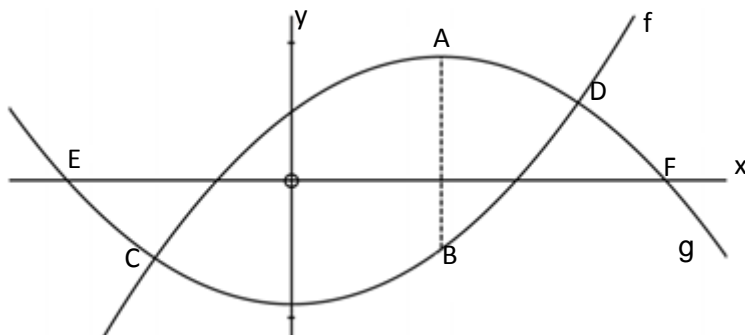(b) The graph below shows the depreciating value of a car over a period of time (in years).
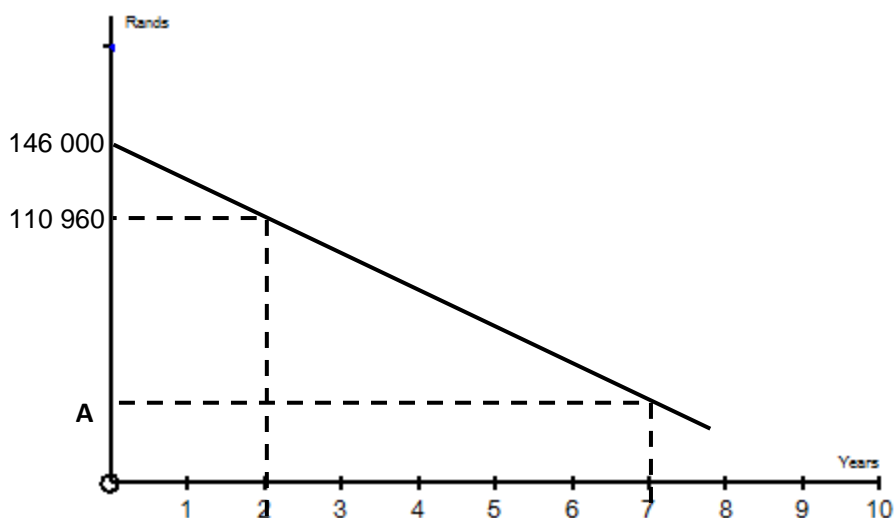
(i) What is the cost of the new car? (1)

(ii) What type of depreciation is illustrated? (1)

(iii) Use the information on the graph to find the rate of depreciation. (3)

(iv) Calculate **A**, the value of the car after 7 years. (2)

[12]

Question 11

Given below are the graphs of the functions $f(x) = -x^2 + 2x - 3$

and $g(x) = x^2 - 4$

(a) Determine the co-ordinates of A, the turning point of g. (3)

(b) AB is parallel to the y-axis, with B on $g(x)$. Calculate the length of AB. (3)

(c) Calculate the length of EF (4)

(d) Determine the values of x such that $f(x) . g(x) < 0$ (3)

[13]

Question 12

(a) Two identical bags are filled with balls.

- Bag A contains 3 pink and 2 yellow balls.

- Bag B contains 5 pink and 4 yellow balls.

- It is equally likely that Bag A or Bag B is chosen.

- Each ball has an equal chance of being chosen from the bag.

- A bag is chosen at random and then a ball is chosen at random from the bag.

(i) Represent the information by means of a tree diagram. Clearly indicate the

probability associated with each branch of the tree diagram and write down all

the outcomes. (5)

(ii) What is the probability that a yellow ball will be chosen from Bag A? (1)

(iii) What is the probability that a pink ball is chosen? (2)

(b) A survey was conducted amongst 180 pupils about their preferences for Coca Cola, Fanta and Sparletta cooldrinks. The findings were:

- 72 drink Coca Cola

- 55 drink Fanta

- 80 Drink Sparletta

- 10 drink all three types

- 17 drink Sparletta and Fanta

- 12 drink Coca Cola and Sparletta

- 18 do not drink any cooldrinks at all.
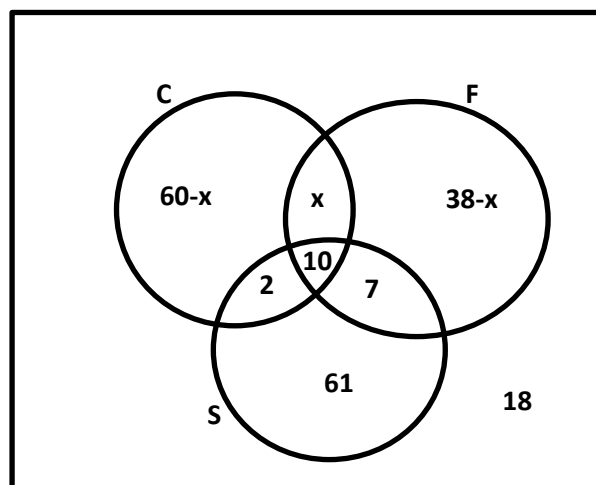
You are given the Venn diagram. Use this information to answer the questions which follow.

(i) Calculate, showing relevant working detail, the probability that a student chosen at random will prefer ONLY Coca Cola? (4)

(ii) What is the probability that if a pupil is randomly selected, she would like exactly two types of cooldrinks? (2)

(iii) Given that a student likes Fanta, what is the probability that the student likes Sparletta? (2)

(iv) Write down $P((C \cap F) \cup S')$ (2)

[18]

Question 13

(a) Draw a rough sketch of the parabola if $y = ax^2 + bx + c$ if $a > 0$, $b > 0$ and the roots are real but have opposite signs. (3)

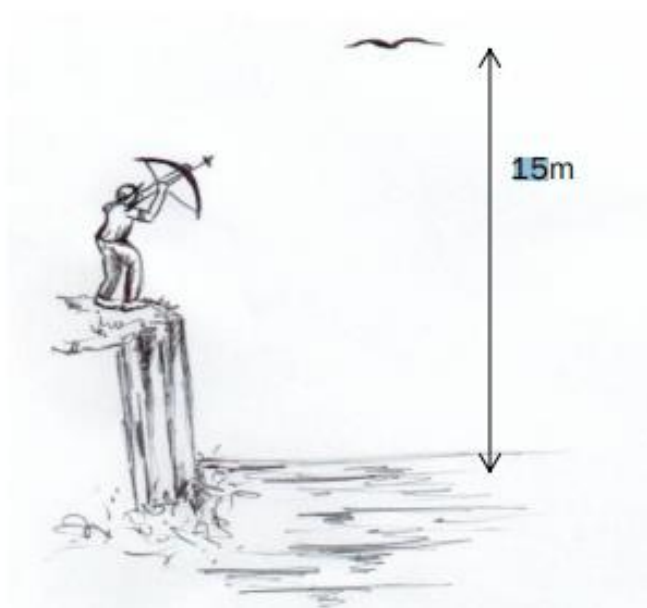(b) Choose the correct answer given $ax^2 + bx + c = 0$ with $4ac - b^2 > 0$.

The roots of $ax^2 + bx + c = 0$ are:

(1) real and unequal   (2) rational
(3) non-real   (4) irrational   (1)

(c) A hunter is standing on a <u>6m high cliff</u>. He shoots an arrow at a bird flying <u>15m above the ground.</u>

The path of the arrow is given by the equation $h(t) = -5t^2 + 13t + 6$

where t = seconds and h = metres above the cliff.

Is it possible to hit the bird?

Show all your working   (4)

[8]